THE BIOLOGY OF SPIDERS AND PHENOLOGY OF WANDERING MALES IN A FOREST REMNANT (ARANEAE: MYGALOMORPHAE)

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Eight syntopic mygalomorph species, four of one genus, are recognised as inhabitants of a small remnant forest. Over six years 1,207 mature males were trapped and collected from a nearby home swimming pool and the wandering times of mature males of the species are compared. The population density within the forest is estimated. It is suggested the high number is because of an 'edge effect' supported by a reduction in predator numbers, an 'island effect' and that mygalomorphs have low dispersion powers, long life cycle and sedentary life style.□*Mygalomorphae, Hadronyche, Misgolas, Stanwellia, community, forest, remnant, phenology, population, syntopic, wandering.*

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Phenological studies of spiders commonly consider the distribution and abundance of species in relation to habitat variation or disturbance (Peck and Whitcomb, 1978; Koch and Majer, 1980). Studies of male spider wandering patterns are less common and are usually associated with taxonomic revisions of particular groups (Coyle, 1971; Raven, 1984). Main (1982) synthesised male wandering data for her studies of arid zone spiders.

This paper presents male wandering patterns over a six year period for six species of syntopic

FIG. 1. Aerial view, easterly aspect, from study site towards Gerringong township.

FIG. 2. Aerial view, south-westerly aspect, of study site. Pool length is 10m.

forest mygalomorphs and also discusses possible ecological effects which could account for the viability of the spider population. The long term data gathering was enabled by the serendipitous location of an in-ground swimming pool acting as a large pit-fall trap close to remnant forest.

STUDY AREA

The study site is on the property 'Scalloway' (34°44'11"S, 150°47'23"E) (Figs. 1, 2), near Gerringong, N.S.W., and is a remnant piece of marginal Complex Notophyll Vine Forest (Bywater, 1978) at an altitude of 110m. It is a fragment (ca 95m x 55m) of the original 'Illawarra Scrub', varying forest types which occupied much of the coastal strip east of the escarpment in South Eastern Australia between the towns of Stanwell Park in the North and Bomaderry on the Shoalhaven River in the south, a distance of 75km. Land clearing removed over 80% of this original vegetation (Fuller and Mills, 1985) and took place mainly between 1850 and 1910, the remnants being restricted to land unsuitable for grazing because of steep gradients and rock outcrops.

The forest overstory includes the trees *Syncarpia glomulifera* and *Alphitonia excelsa* and several vine species forming a discontinuous canopy at a height of about 12m. The understory consists mainly of the small tree *Commersonia fraseri* and the exotic woody scrambling shrub *Lantana camara*. *L. camara* intrudes within the forest but is dense and extensive around the forest edge (not allowed for in the forest dimensions) preventing the entry of cattle.

The site is on the edge of a ridge and slopes rapidly downwards to the north east. The soil is of volcanic origin. The surface soil is thin and spread over a basalt bedrock. Large but moveable rocks are prolific. Leaf litter is ca 5cm deep.

METHODS

Wandering mygalomorph spiders trapped in a 10m long swimming pool 15m from the forest edge were collected daily from 1 July 1985 to 30 June 1991. Variables possibly affecting the numbers of spiders trapped, such as domestic lighting, maintenance of grounds and ability of different species to wander further or more quickly than others, were not taken into account. For three years from 28 August 1986 to 25 October 1989 the burrows within a plot 1.5m^2 were examined weekly.

RESULTS

Community Composition

Mature males of eight species of mygalomorph spiders were collected from the pool, viz.: *Misgolas hubbardi* Wishart, 1992 (Idiopidae), *M. dereki* Wishart, 1992, *M. kirstiae* Wishart, 1992, *M. robertsi* (Main and Mascord, 1974), *Hadronyche* sp. (Illawarra group) and *Atrax* sp.

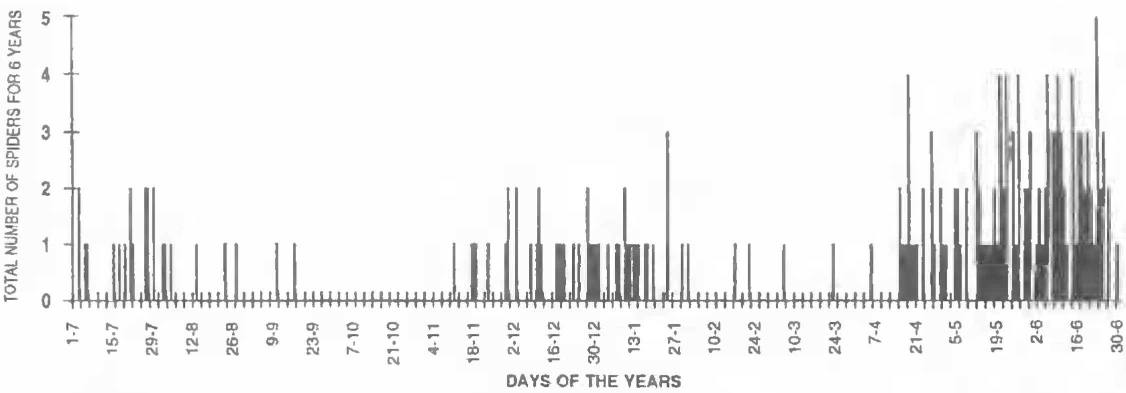

FIG. 3. Total number of *Misgolas hubbardi* captured on same days of years for six years from 1.7.85 to 30.6.91.

(Hexathelidae), *Stanwellia hoggi* (Rainbow, 1914) (Nemesiidae), and *Kiama lachrymoides* Main and Mascord, 1971 (Cyrtaucheniidae). The *Hadronyche* sp. is that referred to as *Hadronyche* sp. 20 by Gray (1987). The *Atrax* sp. is smaller but similar morphologically to *A. robustus* Cambridge, 1877. It differs also in that males wander from October to December whilst those of *A. robustus* wander mainly in January (Gray, 1986). They are considered here to be different species.

Population Density

Because much of the surface area of the forest floor is covered by large rocks and occupied by trees the 1.5 m^2 plot cannot be representative of the whole forest area. However, an extrapolation (based on the assumption that the ratio of the number of burrows occupied by all mature female spider species to the number of burrows occupied by *M. hubbardi* is equivalent to the ratio of the number of captured mature male spiders of all species to the number of captured mature male spiders of *M. hubbardi*) indicates there should be 41 mature female mygalomorphs per m^2 in the 1.5m^2 plot.

In the 1.5m^2 plot the maximum number of burrows counted at one time was 55. These included open burrows, those known to exist but temporarily sealed and very small open burrows of which most failed to persist. There were 27 burrows larger than 8 mm in diameter of which 10 were each occupied by a mature female *M. hubbardi*. Due to physical limitations in accurate-

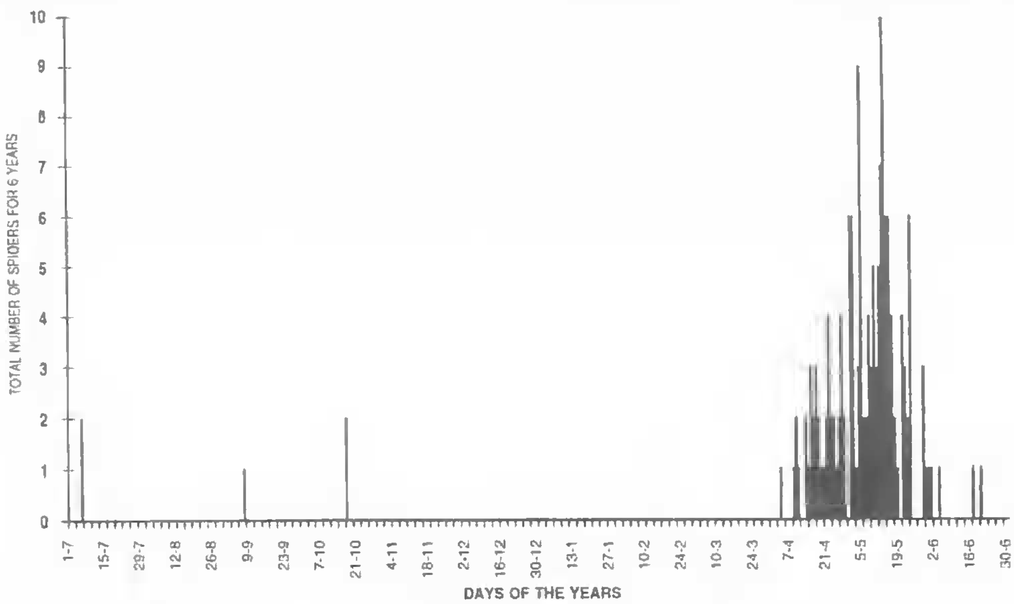

FIG. 4. Total number of *Misgolas dereki* captured on same days of years for six years from 1.7.85 to 30.6.91.

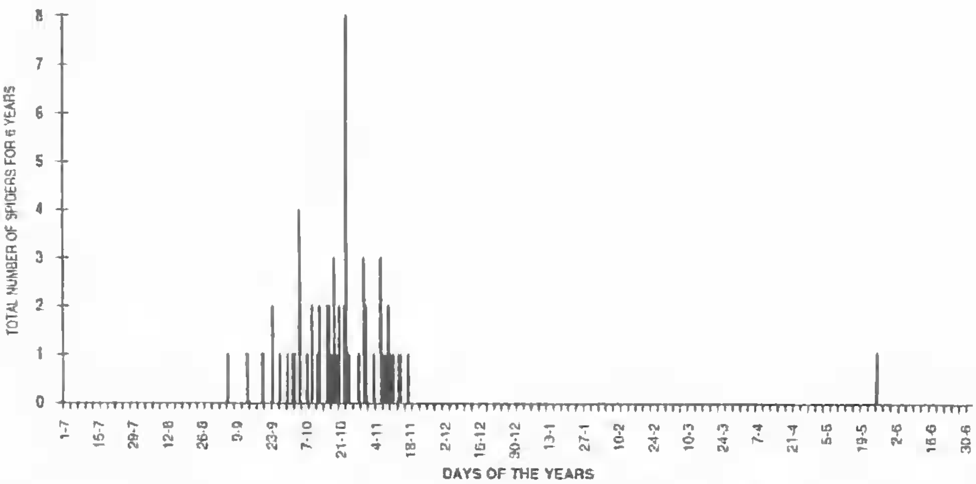

FIG. 5. Total number of *Misgolas kirstiae* captured on same days of years for six years from 1.7.85 to 30.6.91.

ly counting small burrows and recognizing the presence of the burrows of *M. kirstiae* and *Hadronyche* sp. the total count must fall short of the actual mygalomorph population.

PHENOLOGY OF WANDERING MALES (Table 1)

Wandering mature males of *M. hubbardi* were found almost throughout each year (Fig. 3). The extensive wandering period of *M. robertsi* is interrupted during January and February when the frequency of capture is reduced (Fig. 6). The wandering period for *S. hoggi* is also long, extending over six months (Fig. 8). As is customary to expect of male mygalomorphs, the wanderings of *M. dereki* (Fig. 4), *M. kirstiae* (Fig. 5) and *H.* sp. (Fig. 7) are restricted to short and more precise annual periods. The collections of *Atrax* sp. and *K. lachrymoides* were too small for deductions to be conclusive.

During the six year period, 11 female *S. hoggi* were also trapped in the pool during the months from March to October.

Species	Total trapped	Peak active periods	% in peak periods	No. trapped per day
Misgolas hubbardi	197	April-July	58	0-3
		Nov.-Jan.	20	0-2
Misgolas dereki	153	Apr.-June	98	0-7
Misgolas kirstiae	61	Sept.-Nov.	98	0-7
Misgolas robertsi	158	Nov.-May	96	0-4
Hadronyche	606	March-May	96	0-29
Stanwellia hoggi	26	May-Nov.	100	0-1
Atrax sp	5	Oct.-Nov	100	0-2
Kiama lachrymoides	1	Nov		
Total	1207			

TABLE 1. Summary of numbers and timing of male spiders trapped in pool from 1 July 1985 to 30 June 1991.

DISCUSSION

No previous reports have been found of either eight species of mygalomorph spiders or four species of one genus (*Misgolas*) of spiders existing elsewhere syntopically or sympatrically.

The high proportion of mature female *S. hoggi* collected is surprising, 11 females to 26 males, and 10 of the 11 were taken at times coincidental with the male wandering period. The number reflects the long-legged, male-like morphology of the female adapting it to roam. Further, that only one male *K. lachrymoides* was collected may indicate the inability of the male of this species to wander a long distance a reflection in this case of the male's short-legged female-like morphology. The usual sexual dimorphism of mature burrowing mygalomorph spiders (female bulky, stout legged; male less bulky, long legged) is contradicted in these two species.

Some possible reasons for the dense mygalomorph spider population are offered. First, predators of mygalomorph spiders may have become extinct in the area following human settlement. For example, the bandicoot (*Perameles nasuta* Geoffroy, 1804), reputed to be a mygalomorph spider predator (Main, 1976; Preston-Mafham, 1984) and once very common in Willowvale, has been rarely seen by the author and not at all for 15 years. Here then, possibly, is

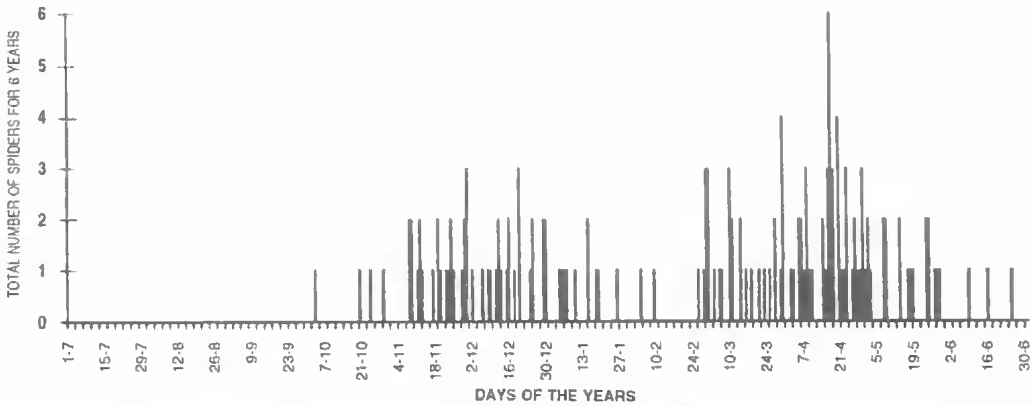

FIG. 6. Total number of *Misgolas robertsi* captured on same days of years for six years from 1.7.85 to 30.6.91.

a paradox where habitat destruction and the introduction of feral animal pests, may increase, not decrease, mygalomorph spider numbers by decreasing spider predators.

Second, the concentration may result from an 'Island Effect' where it is found that the population of an individual species can be far greater than expected when the species is insulated within a small ecological system (separate pers. comms, M.Gray and R.Raven). Also Main (1987) proposed that mygalomorphs are admirably fitted to persist in small isolated areas because of their low dispersion powers, long life cycle and sedentary life style.

Finally, in a larger (ca. 300 ha) forest with complete canopy and separated from the 'Scalloway' site by *ca.* 400m of pasture land there is a paucity of mygalomorph spider burrows and few insects suitable for prey. Burrows are more common near the forest edge, and so too is insect life with grasshoppers, moths and crickets prolific. Because the 'Scalloway' forest remnant is small it is in effect a forest edge throughout with an abundance of suitable prey. Laurence (1991) states, 'In the tropics, forests near edges exhibit striking changes in microclimate, vegetation structure and composition, disturbance regimes, and invasions of species from adjacent habitats. Thus, in fragmented systems, species that tolerate edge conditions are often favoured'. I suggest that this is the explanation for the presence of this dense mygalomorph population.

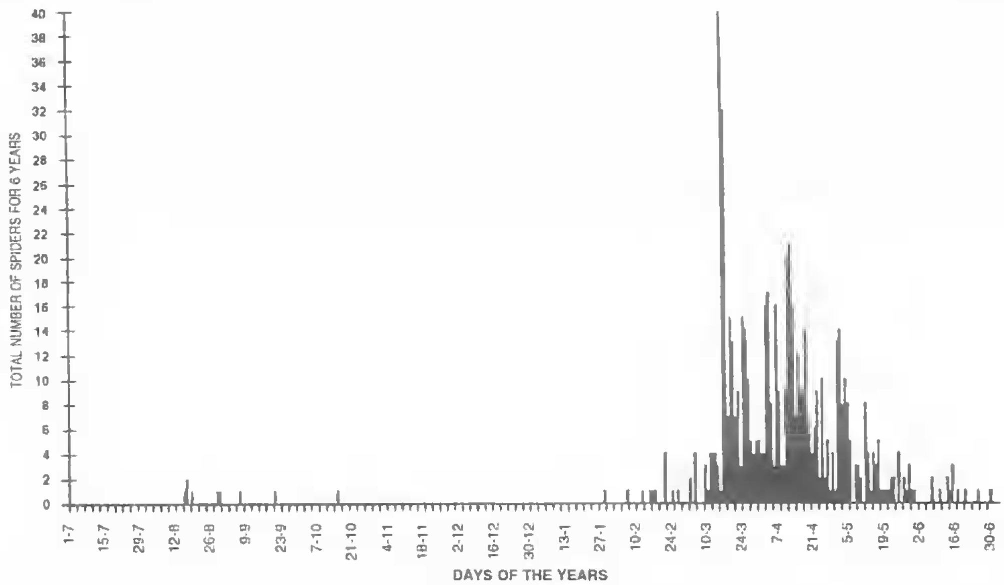

FIG. 7. Total number of *Hadronyche* sp. captured on same days of years for six years from 1.7.85 to 30.6.91.

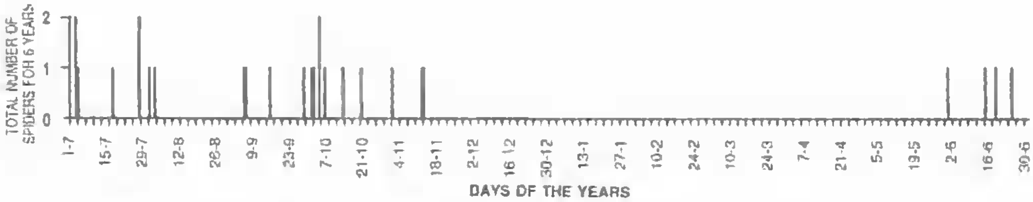

FIG. 8. Total number of *Stanwellia hoggi* captured on same days of years for six years from 1.7.85 to 30.6.91.

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